

Thelypteridaceae Allied to *Phegopteris* in Malaya

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Summary

Following the revised scheme of genera in the family Thelypteridaceae proposed by the author in 1971, a revised account is here given of the genera *Macrothelypteris*, *Pseudophegopteris* and *Metathelypteris* in Malaya; these three genera, together with *Phegopteris* (sensu Ching 1963) appear to form a natural group. Some corrections to the nomenclature of the author's book *Ferns of Malaya* (1955) are made, with revised descriptions where necessary, and the addition of two species *Metathelypteris decipiens* (Clarke) Ching and *M. flaccida* (Bl.) Ching, not previously recorded for Malaya.

In my book on the ferns of Malaya (1955) I described 46 species of the family Thelypteridaceae, but (as stated on p. 236) no natural delimitation of genera had then been devised; those adopted were genera of convenience. It was clear to me that much more detailed observation of plants throughout the oriental tropics was necessary before a better arrangement of genera could be found. Subsequently R. C. Ching (1963) and K. Iwatsuki (1963-65) proposed new systems of classification, but both were mainly based on species of mainland Asia, whereas the family is far more diversified in the Malayan region and the Pacific. For the past eight years I have devoted most of my time and thought to a study of the family throughout the Old World, including Africa, with a glance also at the New World where A. R. Smith of Berkeley is attempting a similar survey. In 1971 I arrived at a new system of genera in the Old World, based on Ching's scheme but with considerable extensions. Since then I have prepared a series of monographs covering all species of individual genera; the series is not yet complete.

My present estimate is that Malaya has at least 54 species belonging to the family; this is about 10% of the total number of species in the Old World, with representatives of most of the genera; most of the missing genera have their main distribution in mainland Asia, but one of them is *Amauropelta* which is mainly American and extends across Africa to the Mascarene Islands.

The object of the present paper is to give a revised account of the Malayan species of a small group of genera which are distinguished by the following combination of characters which was first recognized by Ching: midrib of pinnae prominent but not grooved on the upper surface, and veins not reaching the margin. They also agree in having sori mainly exindusiate, and all genera except *Phegopteris* have some species with amply bipinnate fronds; such fronds do not occur in other genera of the family. I judge that the four genera form a natural group; if anyone wished to unite them, they would collectively bear the generic name *Phegopteris* (which in the strict sense of Ching does not occur in Malaya), but I prefer to maintain them as separate genera. They differ cytologically as follows: *Phegopteris* $n = 30$; *Macrothelypteris* and *Pseudophegopteris* $n = 31$; *Metathelypteris* $n = 35$. These numbers are based on several counts of plants from different sources, and of more than one species, in each case. Thus *Metathelypteris* has the same chromosome number as *Thelypteris* s.str., but the two groups differ in many ways and are certainly not closely related. *Phegopteris* has three species, two of them widely distributed in north temperate latitudes, one in southern China, extending to Tonkin

and Taiwan, with only one Malesian record, in Celebes; I found it to be easily maintained in cultivation at Penang, but it did not propagate itself from spores.

The name *Phegopteris* derives from *Polypodium phegopteris* Linn. It was first used as a generic name to distinguish terrestrial ferns which have exindusiate sori resembling those of *Polypodium*, and was used in the 19th century to cover various different groups of such ferns. The present limitation of the genus is due to Ching (1963: 312). Its distinctive characters are: stipe-scales with marginal acicular hairs but no such hairs on the surface; fronds simply pinnate, pinnae connected by a wing along the rachis, the wing forming semicircular lobes between pinnae.

In the following statement I have not attempted to give a full synonymy for each species, but I do give the following in all cases: (a) the basionym; (b) the name used in my book of 1955; (c) names used in conjunction with previous descriptions; (d) the correct name in *Thelypteris*, if such has been published. A full synonymy for *Pseudophegopteris* and *Macrothelypteris* will be found in my paper of 1969 cited below; it will be given for *Metathelypteris* when I prepare a monograph.

KEY TO THE GENERA IN MALAYA

Fronds simply pinnate; sori distinctly indusiate 1. *Metathelypteris*

Fronds mostly bipinnate; sori exindusiate or with very small indusia:

Slender spreading acicular hairs consisting of several cells, abundant on lower surface of axes of frond; spores with a very fine raised reticulum not distinguishable with light microscope 2. *Macrothelypteris*

Hairs on lower surface all unicellular; spores with a slightly raised surface reticulum of rather large meshes 3. *Pseudophegopteris*

1. *Metathelypteris* Ching 1963: 304. Holttum 1971: 26

Rhizome short, suberect. Fronds simply pinnate with deeply lobed pinnae (in two non-Malayan species bipinnate); veins often forked, not reaching margin; hairs on lower surface acicular or capitate, always unicellular; sori indusiate; no hairs or glands on body of sporangia.

Distribution: about 14 species, widely distributed but few of them anywhere abundant; San Thomé and Fernando Po; Madagascar; Ceylon; N.E. India to China and Japan; throughout Malesia on mountains; Solomon Islands.

Specimens from the islands of the Gulf of Guinea have been identified with the Madagascan *M. fragilis* (Bak.) Holtt. but may represent a distinct species. No specimens have been reported from Madagascar since the original specimen, a single frond, reached Kew in 1877. Another specimen, still undescribed and possibly originating from Nigeria, is the only evidence that plants of this genus now exist in mainland Africa. Only one species of the genus was described in Holttum 1955; two more are here added.

KEY TO THE MALAYAN SPECIES

Lobes of at least the lower pinnae lobed half-way towards costules or more deeply 1. *M. flaccida*

Lobes of pinnae entire or crenate:

Pinna-lobes (except basal acroscopic lobe) entire; pinnae commonly to 6×2 cm; veins often simple in smaller pinna-lobes 2. *M. decipiens*

Pinna-lobes of large pinnae crenate; pinnae commonly larger; almost all veins forked 3. *M. dayi*

1. *Metathelypteris flaccida* (Bl.) Ching 1963: 306.

Basionym: *Aspidium flaccidum* Bl., Enum. Pl. Jav. (1828) 161. Racib. Fl. Btzig 1 (1898) 176.

Synonyms: *Lastrea flaccida* Moore, Ind. Fil. (1858) 92. Bedd., Ferns S. India (1864) t.250; Handbook (1883) 244. — *Dryopteris flaccida* (Bl.) O. Kuntze, Rev. Gen. Pl. 2 (1891) 812. v.A.v.R., Handb. Mal. Ferns (1908) 195. — *Thelypteris flaccida* (Bl.) Ching, Bull. Fan Mem. Inst. Biol. 6 (1936) 336.

Rhizome short, erect. Stipes to 25 cm or more long, pale, hairy in the groove; basal scales 3–4 mm long. Lamina 25 cm or more long, with rather widely-spaced subopposite pinnae, to 10 pairs, thin; basal pinnae narrowed towards base on basiscopic side. Largest pinnae of Malayan specimens 10×2.5 cm, acuminate, lobed almost to the costa; largest lobes lobed $\frac{1}{2}$ way to costule or more deeply; costules to 4 mm apart; veins pinnate in the larger lobules of pinna-lobes, distal veins forked; lower surface of rachis, costae, costules, veins and surface of lamina bearing slender pale erect acicular hairs to $\frac{3}{4}$ mm long; upper surface of costules and veins bearing scattered hairs as those on costa. Sori 1–3 in each lobule of a pinna-lobe, small; indusia thin with short acicular hairs.

Distribution: West Java (type); Sumatra (?); Malaya; Ceylon & S. India; N.E. India to West China.

In 1969 I found plants of this species on sheltered earth banks by a road at 5000 ft near Brinchang, Cameron Highlands; specimens were also collected somewhat earlier by Abdul Samat bin Ali (no. 363) on Maxwell's Hill, Perak. The Malayan specimens are all rather small and have shorter hairs on the lower surface than those from Java and from N.E. India. Prof. Manton found that in Ceylon the species occurs in both diploid and tetraploid forms (Phil. Trans. R. Soc. B, 238:137. 1954). Herbarium specimens from Ceylon at Kew can be separated into those with longer and with shorter, less abundant hairs on lower surface; the Cameron Highlands specimens correspond with the latter. It seems likely that this species will spread in northern Malaya as clearing provides suitable habitats.

2. *Metathelypteris decipiens* (Clarke) Ching 1963: 306.

Basionym: *Nephrodium gracilescens* (Bl.) Hook. var. *decipiens* Clarke, Trans. Linn. Soc. II, Bot. 1 (1880) 514, t.65, fig. 2.

Synonyms: *Lastrea gracilescens* var. *decipiens* Bedd., Handb. Suppl. (1892) 51. — *Thelypteris decipiens* Ching, Bull. Fan Mem. Inst. Biol. 6 (1936) 335.

Rhizome short-creeping or suberect with fronds closely tufted at its apex. Stipe 15–25 cm long, pale except for darkened base, very-short-hairy; scales narrow, 2 mm long, bearing short hairs. Lamina to 30 cm long, with about 12 pairs of free pinnae; basal pinnae sometimes a little reduced, often narrowed at the base on basiscopic side; texture thin. Largest pinnae on Indian specimens 9×2.5 cm, commonly 6×2 cm, on Malayan specimen 5×1.3 cm, short-acuminate with upcurved tip, lobed almost to costa; basal acroscopic lobe often enlarged and crenate, other lobes entire, slightly oblique, hardly falcate; costules to $3\frac{1}{2}$ mm apart; veins to 6 pairs, those in acroscopic basal lobes mostly forked, in other lobes mostly simple; lower surface of rachis, costae and costules bearing scattered short hairs, also short brown linear scales; upper surface of costae densely hairy, scattered similar hairs on costules and veins. Sori medial or a little supramedial; indusium small, pale, with minute capitate hairs.

Distribution: Darjeeling district; Khasia Hills in Assam; in Malaya only found once on rocks in opening of mossy forest, by waterfall, Gunong Batu Brinchang, 6000 ft (Molesworth Allen 5005).

This species is very near *M. gracilescens* (Bl.) Ching, differing in broader pinna-lobes of the largest fronds, with acroscopic basal lobes enlarged and crenate, and in having some veins forked in the larger pinna-lobes. The Malayan plant matches specimens from the Khasia Hills very closely; it is not mentioned in the appendix to the second edition of my book. *M. gracilescens* (type species of the genus) has a wide distribution on mountains in the Malayan region (Sumatra, Java, Borneo, Philippines, New Guinea) also Taiwan and southern Japan; it has not yet been found in Malaya.

3. *Metathelypteris dayi* (Bedd.) Holttum 1976: 117.

Basionym: *Nephrodium dayi* Bedd., Journ. Bot. 25 (1887) 323.

Synonym: *Lastrea dayi* Bedd., Handb. Suppl. (1892) 54.

Misapplied name: *Thelypteris singalanensis* sensu Holttum 1955: 243, fig. 138.

I have no corrections or addition to the description of 1955, but here provide a correction of the name. The type of *Nephrodium singalanense* Bak. represents a Sumatran species distinct from the Malayan one; it has abundant minute capitate glandular hairs all over the lower surface and the fronds are thinner in texture, drying a darker green. It may be a forest plant, whereas the Malayan *M. dayi* grows in rather open places, not in full forest shade. A plant from Taiping Hills investigated by Prof. Manton proved to be tetraploid; the Sumatran *M. singalanensis* might be diploid.

Distribution: Sumatra, Malaya, West Java, Borneo, Philippines, New Guinea.

2. *Macrothelypteris* Ching 1963: 308. Holttum 1969: 25

Rhizome short, prostrate or suberect; scales at base of stipes narrow, thickened near their bases, with short acicular or capitate marginal and superficial hairs; fronds amply bipinnate-tripinnatifid with adnate pinnules; scales on rachis (if present) often with thickened bases, sometimes with marginal hairs, always with an acicular hair-tip, usually grading to septate hairs on distal parts of frond; sori small, with small indusia obscured by ripe sporangia; sporangia bearing capitate hairs; spores with a very fine surface-reticulum not distinguishable in detail with the light microscope, sometimes with slight wing-like outgrowths.

Distribution: about 9 species, from the Mascarene Islands to warmer parts of mainland Asia, throughout Malesia, widely in the Pacific. In Malaya only one species, which needs no new description but has an earlier name than that cited in Holttum 1955.

Macrothelypteris torresiana (Gaud.) Ching 1963: 310. Holttum 1969: 27.

Basionym: *Polystichum torresianum* Gaud. in Freycinet, Voy. Bot. (1824) 333.

Synonym: *Thelypteris torresiana* (Gaud.) Alston, Lilloa 30 (1960) 111.

Name in Holttum 1955: *Thelypteris uliginosa* (Kunze) Ching.

This species is at once distinguishable by its glaucous stipe with dark narrow basal scales and by the presence of slender acicular hairs more than 1 mm long and consisting of several cells, which take the place of scales on the lower surface of axes of the frond. It is distributed almost throughout the range of the genus and has also become established through human agency in various parts of the American tropics. It is not a common species in Malaya, except in the north, in open places in the lowlands, though easy to cultivate in Singapore.

It would not be surprising if *M. multiseta* (Baker) Ching, described from G. Matang near Kuching, Sarawak, and occurring at c. 3000 ft in the Padang Highlands of Sumatra, were to appear in open places on the mountains of Malaya. This species has larger fronds than *M. torresiana*, with reddish stipes and copious stiff spine-like scales throughout stipe and rachises.

3. *Pseudophegopteris* Ching 1963: 313. Holttum 1969: 12

Rhizome various, in the Malayan species erect, in *P. aurita* (Hook.) Ching long-creeping and slender. Stipe and rachis usually reddish, basal scales thin, red-brown when dry, edges not ciliate; scales on frond usually few, appressed, reduced to a single row of short cells with red transverse walls. Lamina usually large (smallest in the Malayan *P. rectangularis*), much longer than wide, with $\pm$ reduced lower pinnae; in bipinnate fronds the lamina of pinnules adnate to pinna-rachis; hairs on frond acicular or short-capitate, always unicellular. Sori exindusiate, often spreading a little along the veins; sporangia sometimes bearing acicular hairs near annulus; spores pale, with a slightly raised reticulum of rather large meshes.

Distribution: 21 species, distributed from the islands of St Helena and San Thom  (Atlantic Ocean) to Hawaii; in Malesia only on mountains in open places.

The two Malayan species are named *Thelypteris oppositipinna* and *T. brunnea* in my book of 1955. Both names must be changed, and a new description of the latter is provided. The only other species which might occur in Malaya is *P. aurita* (Hook.) Ching, which was described from N.E. India and has been found on Mt Kinabalu and the highlands of eastern New Guinea; it might occur on the exposed upper parts of Gunong Tahan. In New Guinea this species was found to be tetraploid, but in Ceylon it is diploid.

Pseudophegopteris rectangularis (Zoll.) Holttum 1969: 19.

Basionym: *Polypodium rectangulare* Zoll., Syst. Verz. (1854) 37, 48.

Name in Holttum 1955: *Thelypteris oppositipinna* (v.A.v.R.) Ching.

Distribution: N.E. India; Sumatra, Malaya, Borneo, Java, at 3000–5000 ft.

The name *rectangularis* was based on a specimen from Java, the later name *oppositipinna* on a specimen from Sumatra; the species also received other names elsewhere (see Holttum 1969 for full synonymy). The few Malayan specimens have been found in rather dry exposed ground in or near stream-beds, whereas plants of *P. paludosa* (see below) grow in wet ground by streams. It would be interesting to transplant *P. rectangularis* to see whether different environmental conditions would cause it to vary from its normal characters as described and figured in my book.

Pseudophegopteris paludosa (Bl.) Ching 1963: 315. Holttum 1969: 23.

Basionym: *Polypodium paludosum* Bl., Fl. Jav. Fil. (1851) 192, t. 90.

Name in Holttum 1955: *Thelypteris brunnea* in part, excluding Indian plants.

Correct name in *Thelypteris*: *T. paludosa* (Bl.) K. Iwats., Acta Phytotax. Geobot. 19 (1961) 11.

Rhizome erect, massive in well-grown plants. Stipe 50 cm or more long glabrescent, reddish; basal scales to c. 10×2 mm, very thin. Lamina to 120 cm or more long; free pinnae to c. 15 pairs, opposite, lower pinnae somewhat reduced and more widely spaced, basal pinnae 25 cm long on a frond with largest pinnae 33 cm; basal basiscopic pinnule or pinna-lobe longer than acroscopic. Pinnules broadly adnate to pinna-rachis, usually connected by a very narrow wing, grading distally to the deeply lobed apical part of the pinna; largest pinnules (apart from basal ones) about 4×1 cm, deeply lobed, veins pinnate in the lobes; lower surface

of pinna-rachis and costae of pinnules bearing stiff spreading slender acicular hairs $\frac{2}{3}$ – $\frac{3}{4}$ mm long, shorter and thicker hairs on upper surface. Sori usually 2 pairs in each pinnule-lobe, round or nearly so; sporangia lacking hairs near annulus.

Distribution: Malesia, Sumatra to New Guinea, on mountains at 4000–7000 ft, in open wet ground by streams; rather few collections.

When writing my book of 1955 I had only seen one plant of this species, which I found in an early clearing (for the trout hatchery) near Brinchang at Cameron Highlands in the 1930's; I also saw a plant collected by Mrs Allen at Fraser's Hill. As Mrs Allen has reported (Gard. Bull. Sing. 17: 260. 1958) the species increased greatly in the later large clearings at the Highlands, and I saw it growing abundantly by streams above Brinchang village in 1969; these Malayan plants certainly agree closely with specimens from the mountains of West Java, whence Blume had the type of his species.

The name *Thelypteris brunnea* applied to the Malayan species by me in 1955 was based on *Polypodium brunneum* Wall., published without a description in a list of the specimens in Wallich's herbarium. The earliest valid name for the Indian species is *Phegopteris pyrrhorhachis* Kunze, based on a specimen from the Nilgiri Hills in southern India; the rhizome is somewhat prostrate and the fronds are never so large as in *P. paludosa*. In Ceylon Prof. Manton found both tetraploid and hexaploid forms of this species. Malayan plants of *P. paludosa* look very uniform at Cameron Highlands.

Mrs Allen remarked that she had found *P. rectangularis* and *P. paludosa* growing together, and it would not be surprising if intermediates were found. It should be noted that, apart from the great difference in size (which would not apply to young plants of *P. paludosa*) the two species differ constantly in the presence of stiff hairs on the sporangia *P. rectangularis* (see Holttum 1955 fig. 137) and their absence in *P. paludosa*.

The plants from Mt Kinabalu mentioned by Mrs Allen in her note on *Thelypteris brunnea* above-mentioned are *Pseudophegopteris aurita* (Hook.) Ching.

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